How well do meteorological indices explain forest fire ocurrence in Germany?

Anne Holsten (1), Anto Raphael Dominic (2), Luis Costa (1), and Jürgen P. Kropp (1)

(1) Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany, (2) Eberswalde University for Sustainable Development, Eberswalde, Germany

Meteorological forest fire risk indices have been developed to forecast the risk of fire occurrence and aid forest managers to take suitable preventive measures. We evaluate five meteorological fire risk indices and relevant meteorological variables for their predictive capacity against monthly fire statistics for 13 German states between 1993 and 2010. Mean relative humidity stands out as the best overall predictor (for 9 out of 13 states) for the recorded number of fires with a median correlation coefficient for Germany of -0.7. The indices with best explanatory power were, in decreasing order, the German modified M-68, the Canadian Fire Weather Index and Angström. The correlations of fire data with relative humidity and fire indices were stronger for states particularly prone to fire occurrence. At the monthly scale, correlations of relative humidity and fire indices with area burnt are in average weaker than with the number of fires. For the same time period, we investigated the performance on a daily scale for the state of Brandenburg. In this case, the performance of fire indices and relative humidity were more similar than at the monthly level. In addition, the number of fires could be explained equally well as the area burnt. Climate projections under different temperature and moisture conditions consistently indicate a monthly decrease in relative humidity until 2060, particularly in the summer months. Future monthly values of M-68 also denote a considerable increase of fire risk in summer. The increase in fire risk at the beginning and end of the fire season points to a possible extension of the current fire season. Our results reveal that mean relative humidity is sufficient to describe observed fire occurrences in Germany at both monthly and daily scales. Correlation coefficients were robust in state, country, monthly and daily analysis. Due to its predictive power and simplicity of calculation, relative humidity is a valid or better alternative in Germany as a proxy for monthly forest fire risk.